



Linking Through a Common Understanding of the Battlespace: JWARS and the JWARS/JSIMS Conceptual Model of the Mission Space (J²CMMS)

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J2CMMS: Linking Through A Common View of the Battlespace

- Background**
- J2CMMS Purpose**
- Linkage Methodology**
- An Example**
- Lessons Learned**

Principal rationale for developing a common view of the Mission Space include:

- **Opportunity for reuse given common Mission Space**
- **Opportunity to leverage work between two programs**

Knowledge Acquisition

High-Level & Detailed Design

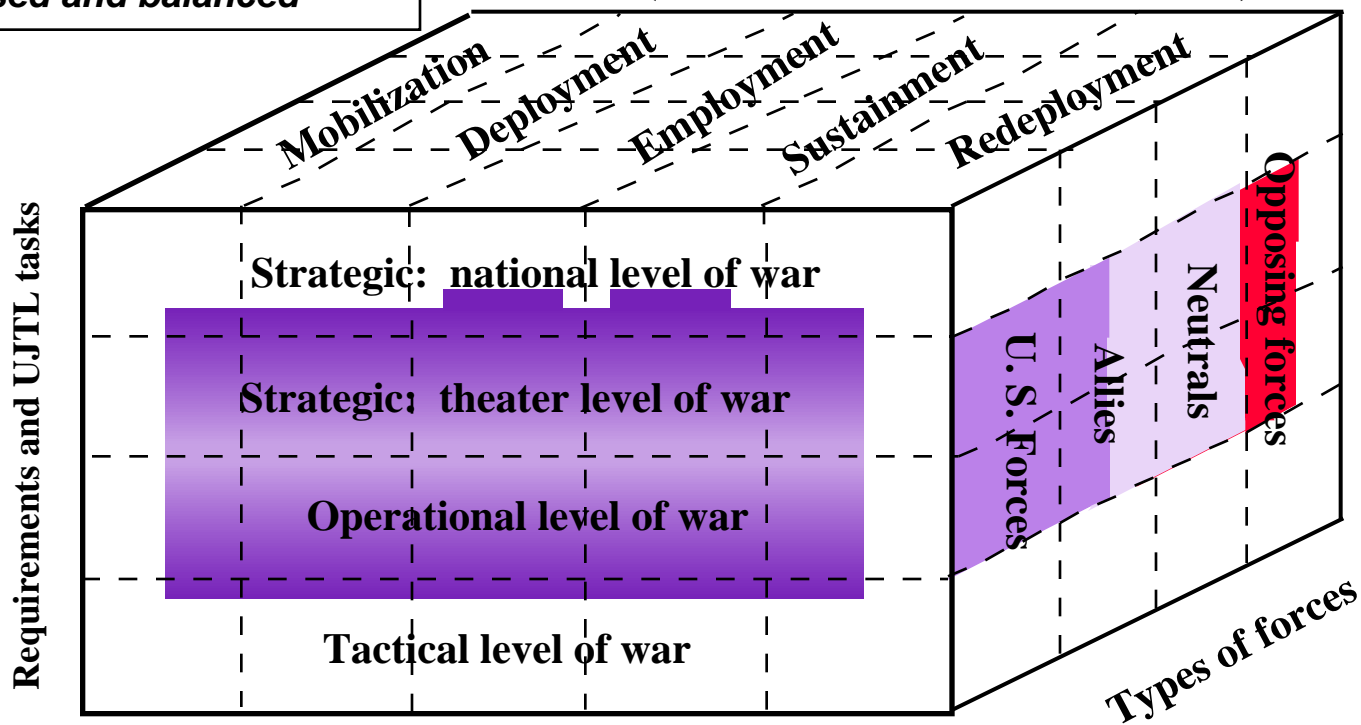
Implementation

Knowledge acquisition, or Mission Space Analysis is the area of greatest overlap between JWARS & JSIMS

J2CMMS Mission Space: Large & Complex

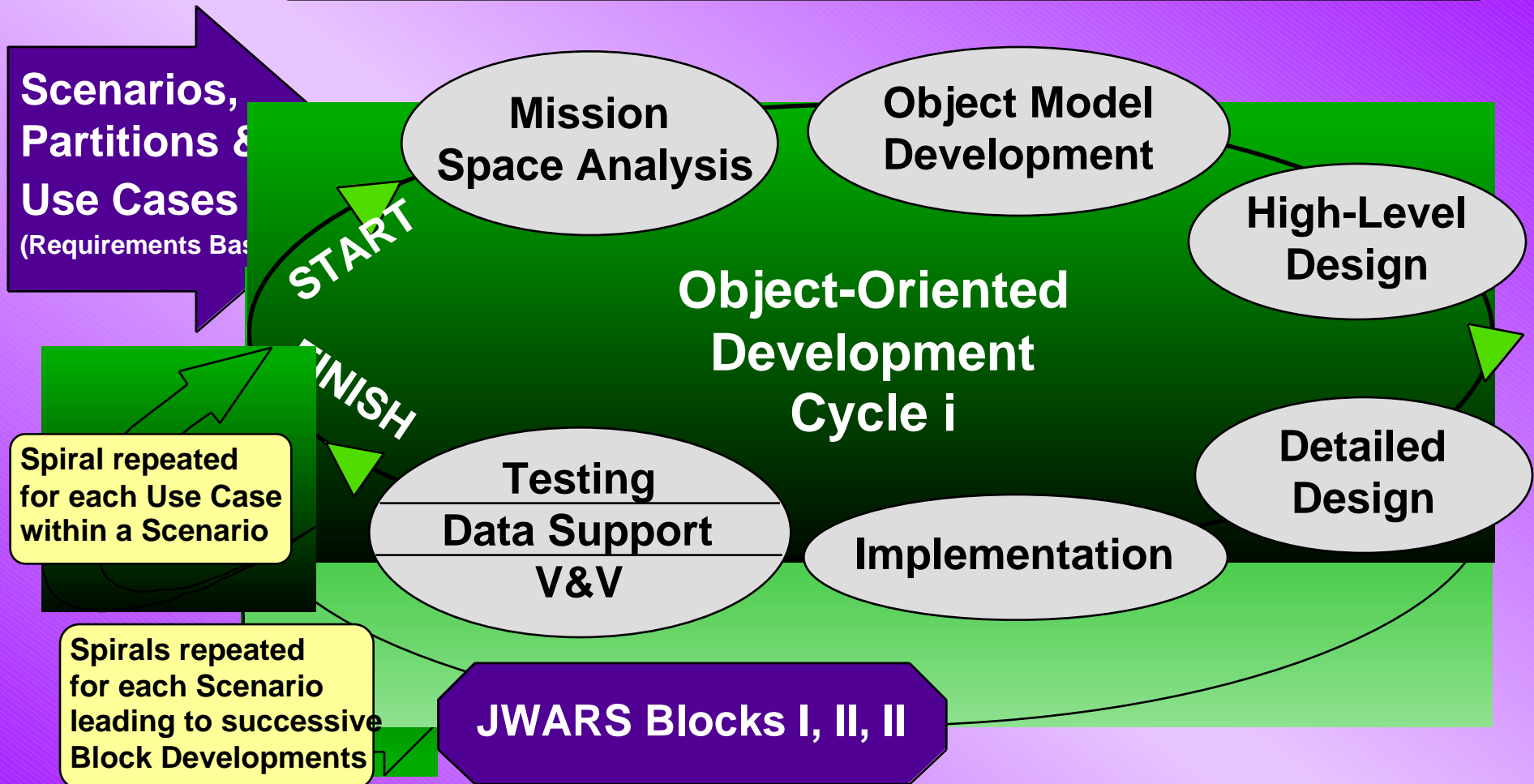
Mission Space research and analysis must be organized, focused and balanced

Phases of military operations
(for war and MOOTW scenarios)





J2CMMS and the JWARS Software Development Process



- Spiral approach
- Government guidance and control at every step
- Gov't subject matter experts critical at every step

J2CMMS - Purpose

- Conduct knowledge acquisition (KA) of the joint mission space through *research and analysis*
- Document the results in a J2CMMS repository
- Medium to transfer the knowledge to OO analysts to start OO knowledge engineering activities
- Form a basis for VV&A activities



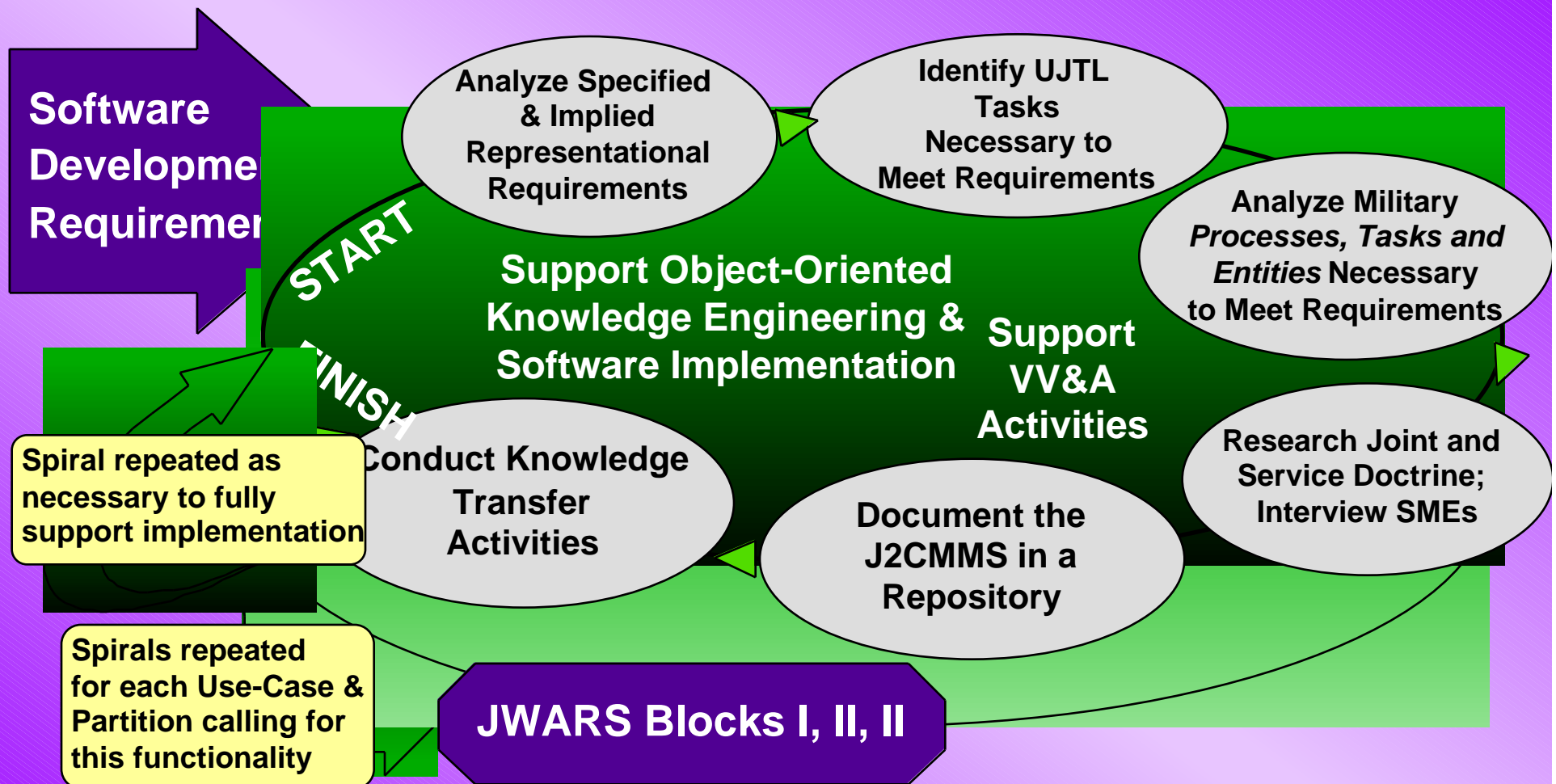
J2CMMS - Components

Gather Information	Organize Data	Develop Conceptual Object Model	Balanced Entity & Action Conceptual Models
<ul style="list-style-type: none">• Doctrine• SMEs• Site Visits• Common reference scenario	<ul style="list-style-type: none">• Structured text & formats• Diagrams• Templates• Lexicon & naming conventions	<ul style="list-style-type: none">• Common Syntax and Semantics (CSS)• Document & archive• Integrate across functional areas	<ul style="list-style-type: none">• Application independent• Traceable to requirements and sources• Enables partitioning of software engineering tasks

- KA is *doctrine based*, augmented by SMEs
- Supports model development through implementation
- J2CMMS development is an integral part of the JWARS software engineering process
- Research must provide *balanced entity and action views*
- Data & information organization must facilitate rapid understanding and knowledge transfer
- *Common reference scenarios* provide needed context to the research & analysis



JWARS J2CMMS Development Process



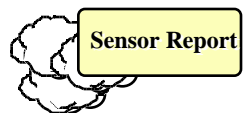
- Process adapted to JWARS spiral development approach
- J2CMMS evolves as model development iterates
- Initially, process/entity (functional) oriented



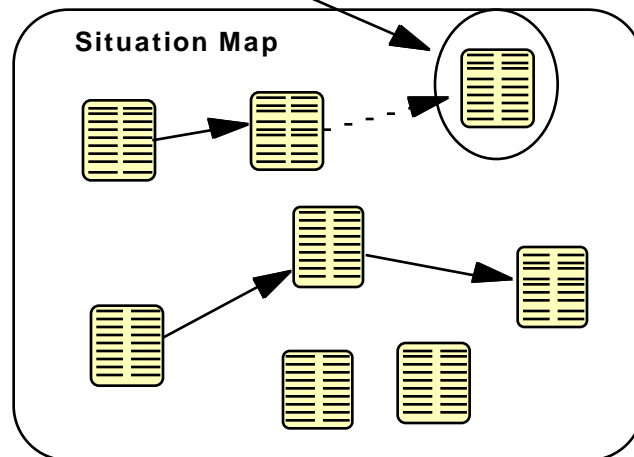
An Example: Perception and the Fusion Process

Goal:

- Relate incoming sensor reports to a virtual SITMAP - - Correlation
- Compare perception (SITMAP) to expectations (IPB) - - Assessment

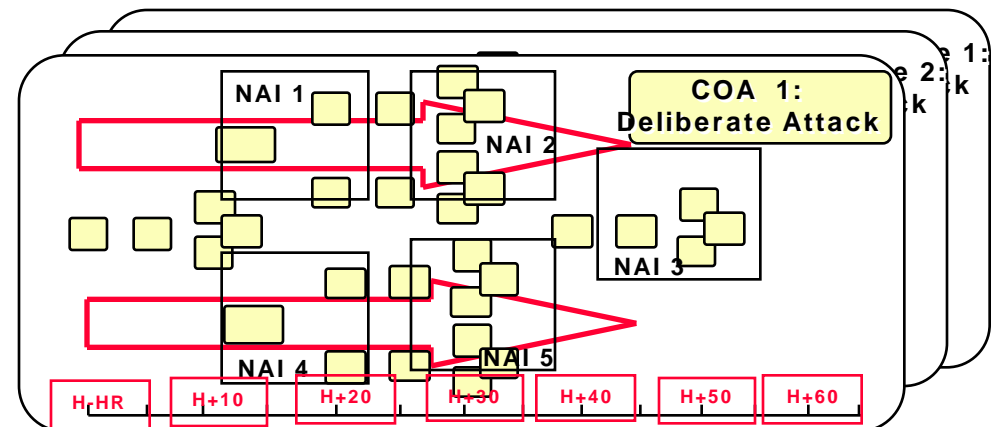


Correlation



SITMAP contains perceived threat entity matrices.
Each matrix reflects information reported by sensors.

Assessment



Threat Course of Action (COA) templates describe expected activities within NAIs over time.

Algorithm(s) find “best fit” between known situation (Situation Map) and Threat templates created as user input during IPB



Example - Developing CMMS for *Battlespace Perception*

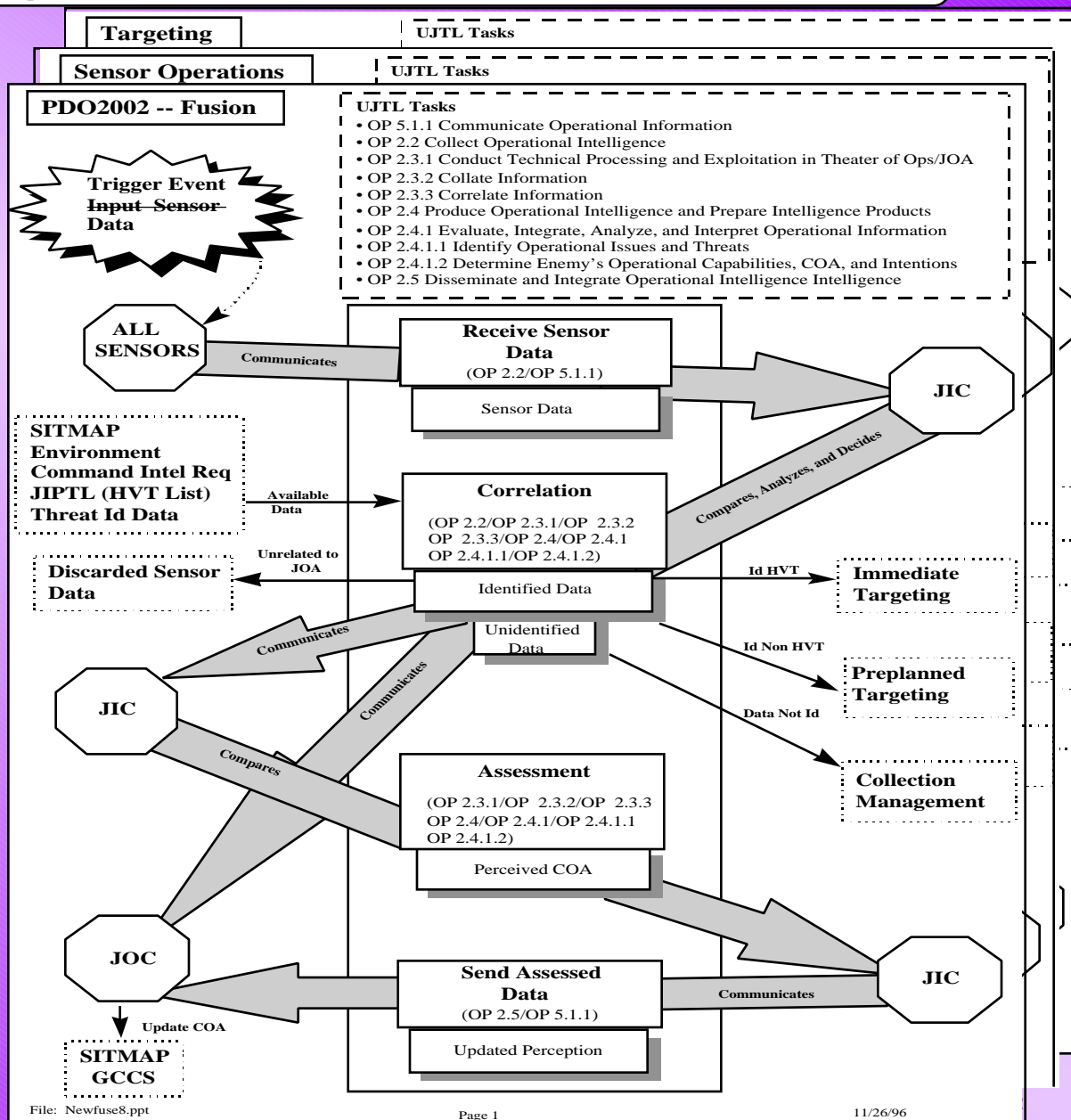
Entity	Process	Action
Staff Sections	<ul style="list-style-type: none"> • Conduct IPB • Predict enemy courses of action 	<ul style="list-style-type: none"> • Analyze weather • Analyze terrain/ocean • Analyze enemy
Staff Sections	<ul style="list-style-type: none"> • Plan intelligence collection operations 	<ul style="list-style-type: none"> • Identify targets • Identify collectables • Associate with time & space • Match sensors with targets
Sensors	<ul style="list-style-type: none"> • Conduct collection operations 	<ul style="list-style-type: none"> • Prioritize targets • Allocate assets • Plan missions • Execute missions • Report results
Staff Sections	<ul style="list-style-type: none"> • Process incoming sensor reports • Relate reports to dynamic situation 	<ul style="list-style-type: none"> • Receive reports • Route reports • Correlate information to SITMAP
Staff Sections	<ul style="list-style-type: none"> • Update assessment of enemy activities 	<ul style="list-style-type: none"> • Update knowledge • Match current situation to predicted courses of action • Decide which course of action the enemy is following



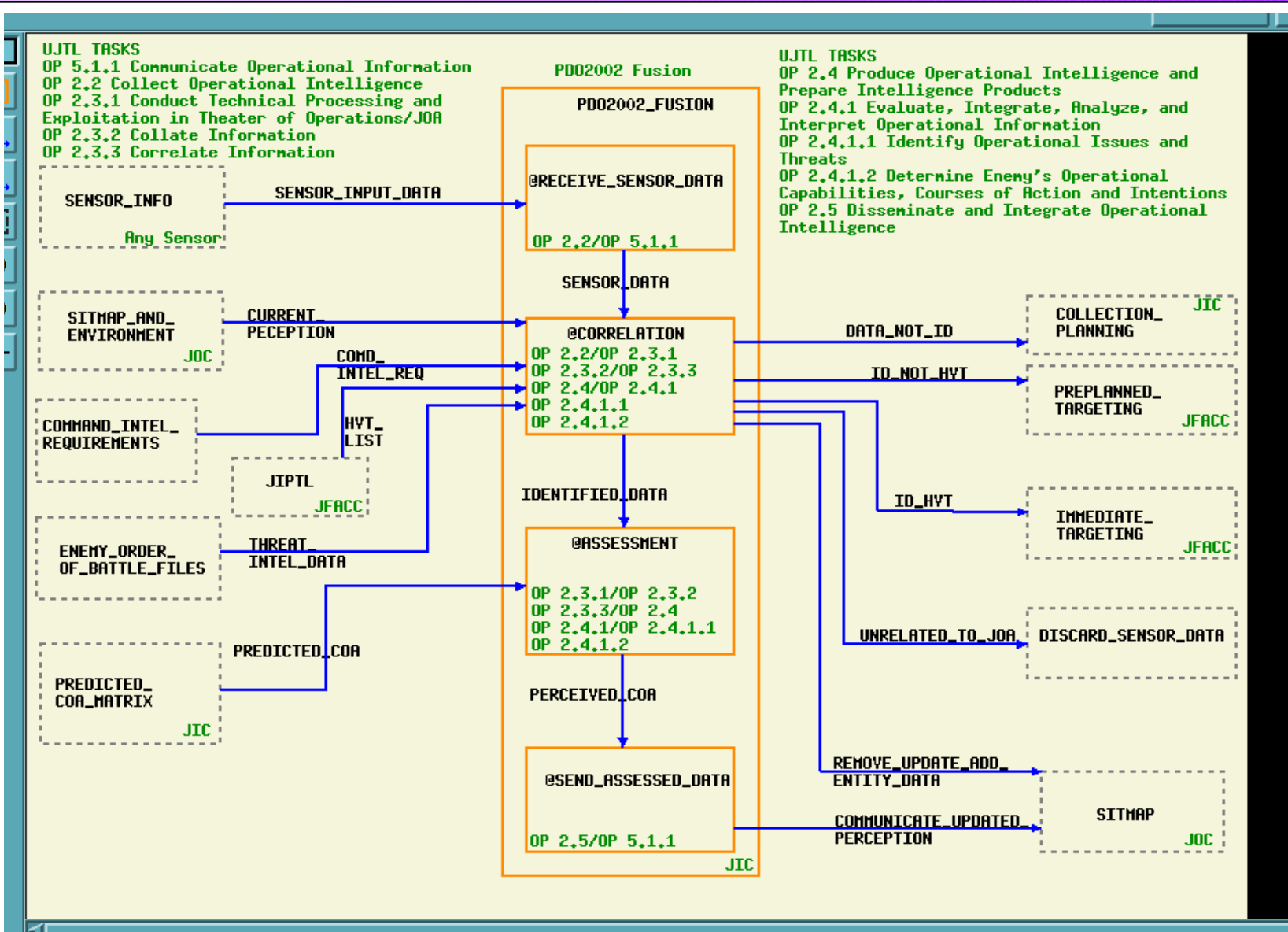
J2CMMS Example: Intelligence Fusion Entities & Process

Desired Outcomes:

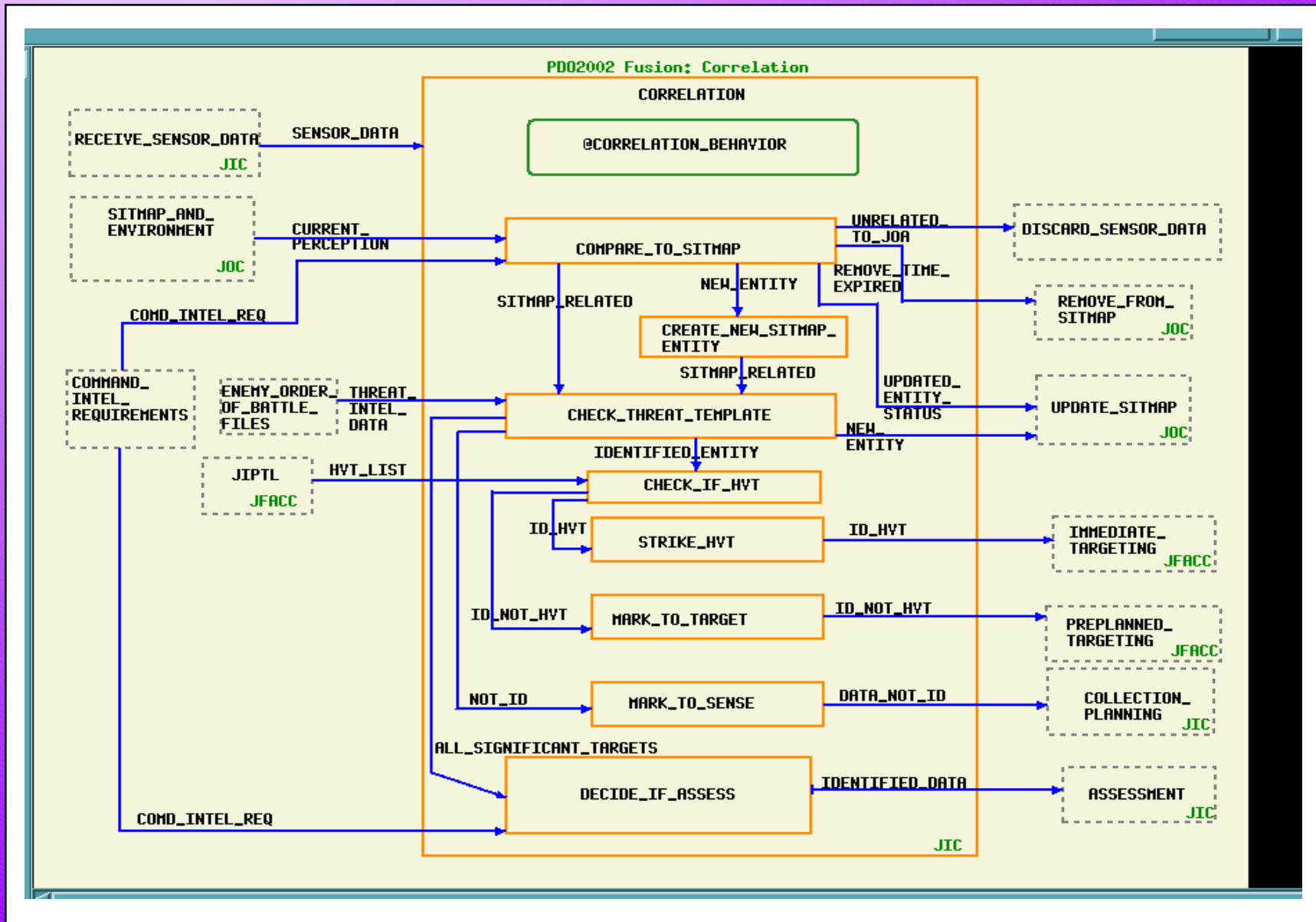
- Identify relevant entities
- Identify processes & tasks
- Describe interactions given a common reference scenario
- Describe outputs from the processes and interactions
- Identify pertinent UJTL tasks
- Document references and sources
- Provide a *medium for knowledge transfer* to the object analyst and software engineer



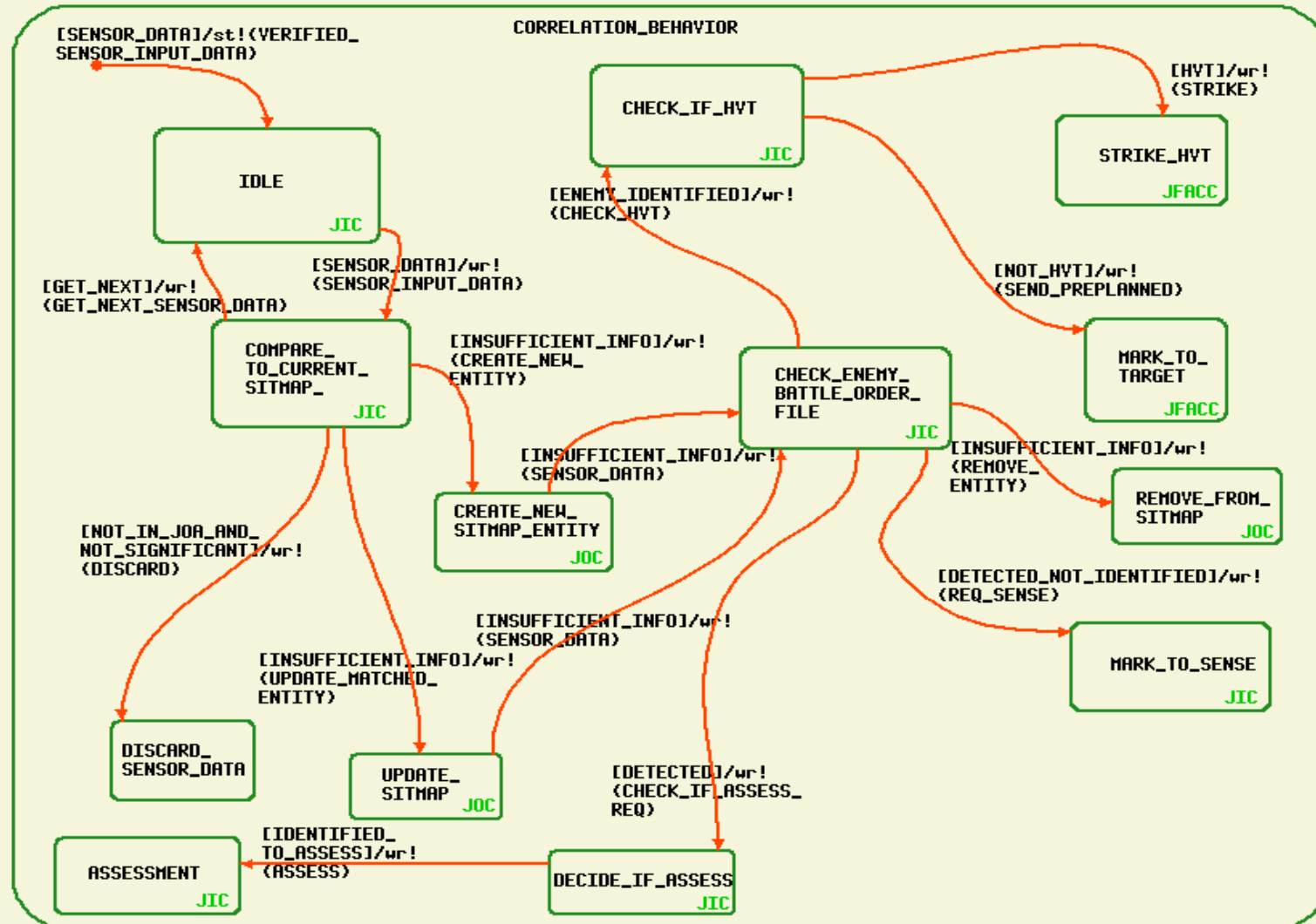
Mission Space Model STATEMATE Output: Fusion Activity Diagram



Mission Space Model STATEMATE Output: Fusion - Correlation Activity Chart



Mission Space Model STATEMATE Output: Fusion - Correlation State Chart





J2CMMS Exchange Through CSS & DIF

Common Syntax & Semantics (CSS)

Entities

- JTF Hqs
- JFACC Hqs
- Operations Section
- Intelligence Section
- Collection Mgt Section
- Wing
- Sensor System
- Downlink Station

Facilitate a Shared Understanding of Terminology, Entities, Actions Tasks and Interactions

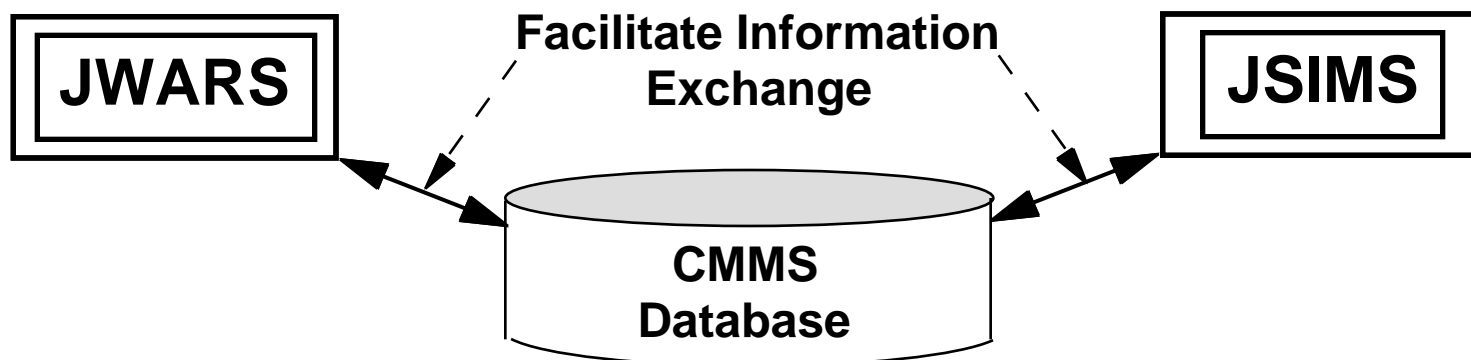
Interactions

- Request sensor availability
- Allocate sensors to missions
- Execute sensor missions
- Report results

Tasks

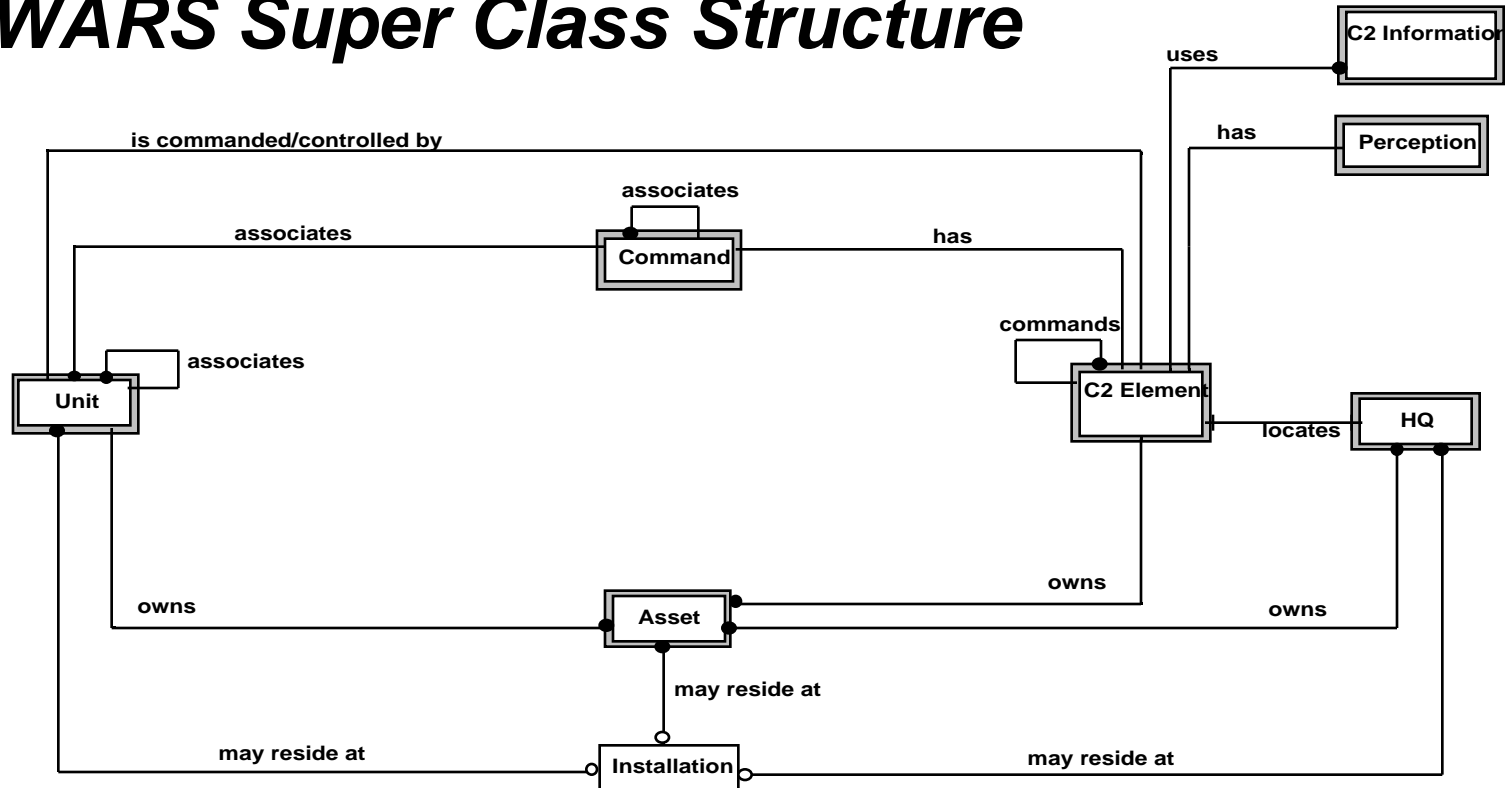
- Identify threat
- Develop Courses of Action
- Develop NAIs
- Develop sensor and target pairs
- Complete collection plan
- Task sensors
- Collect & report

CASE-Tool-Specific Data Interchange Formats (DIFs)



JWARS OOA Object Model: Object Classes Related to Intelligence Fusion

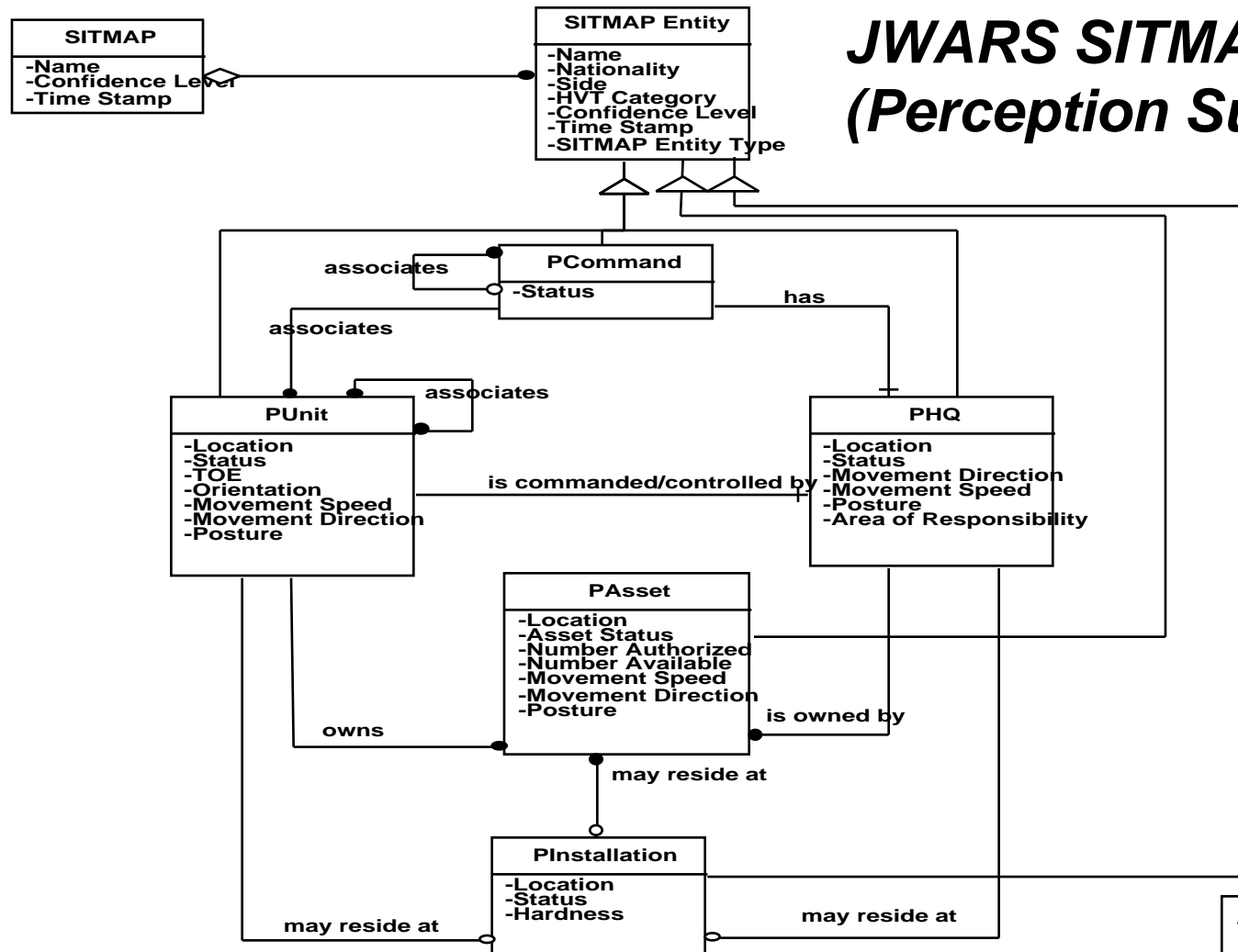
JWARS Super Class Structure



obj_high_level
Thu Jan 2 13:47:48 199
Class Diagram

JWARS OOA Object Model: Object Classes Related to Intelligence Fusion

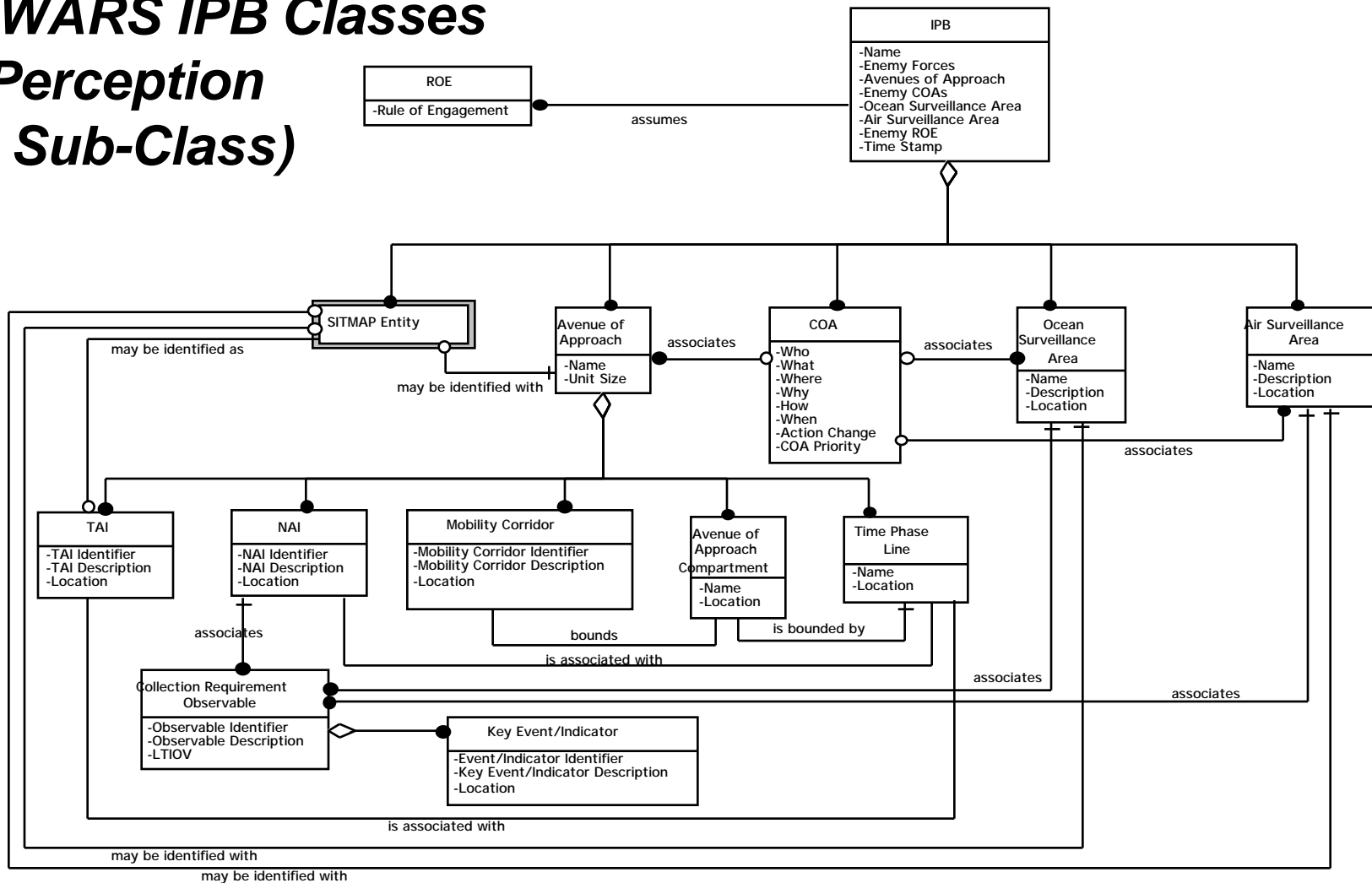
JWARS SITMAP Classes (Perception Sub-Class)



obj_sitmap
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Class Diagram

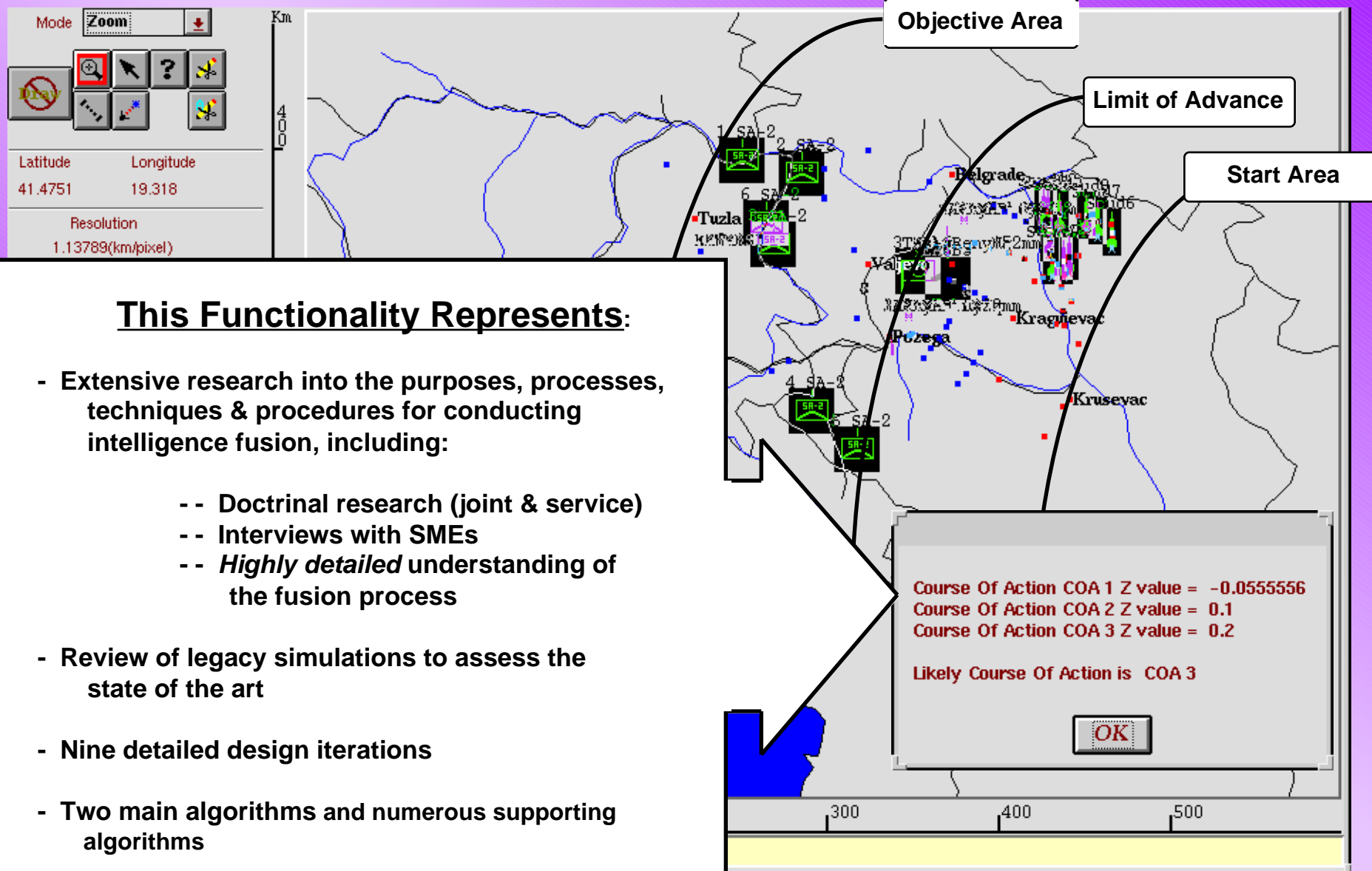
JWARS OOA Object Model: Object Classes Related to Intelligence Fusion

JWARS IPB Classes (Perception Sub-Class)



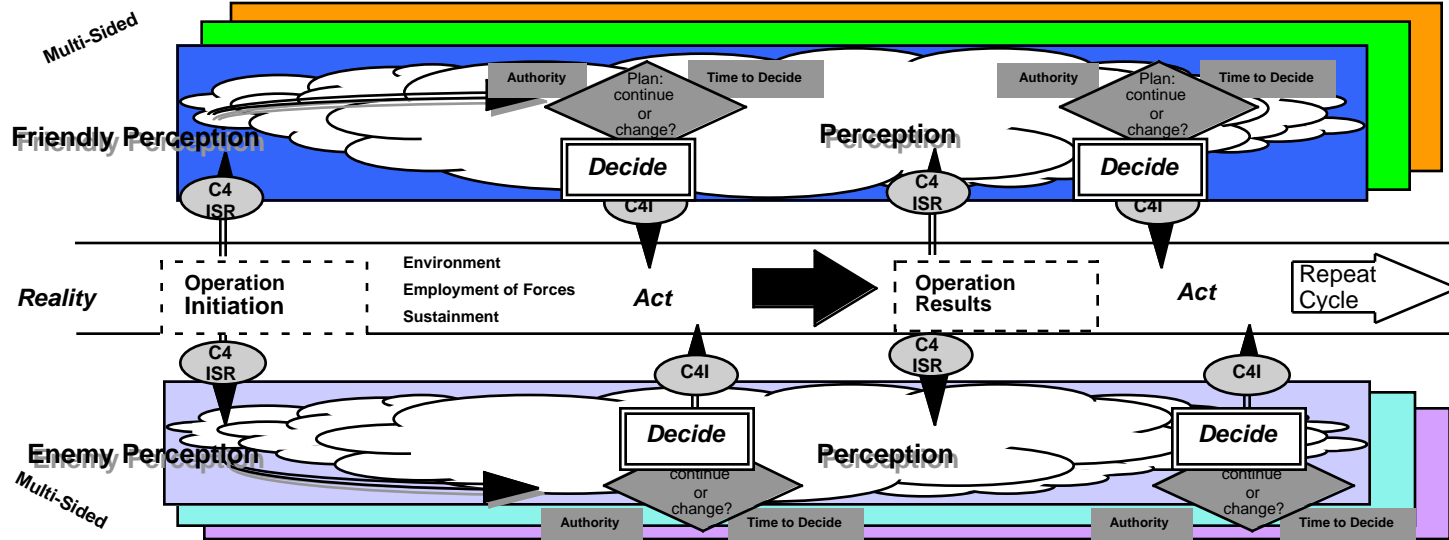


J2CMMS: *Implementation is the Payoff*



Role of the Mission Space Analysts:

- **Knowledge transfer**
 - - **Critical to project success**
 - - **Very time consuming**
 - - **Necessary during OOA, OOD and implementation**
 - - **Difficult - different backgrounds required for the KA and KE functions**
 - - **STATEMATE CASE tool facilitates**
- **Follow processes through implementation**
 - - **Monitor functionality evolution**
 - - **Head team supporting software engineer**



Know your core reasons for building the model:

- These influence KA, design & implementation;

Some JWARS examples:

- - Effect of information on battle outcomes
- - Maintain balance between services
- - Emphasize uniquely joint functions
- - Provide timely & transparent results